

WHAT IS CLAIMED IS:

1 1. An optical device comprising
2 a primary grating;
3 a light source disposed opposing a predetermined side of the primary grating;
4 a first reference grating disposed between the light source and the primary
5 grating;
6 a photodetector disposed opposing the predetermined side of the primary
7 grating; and
8 a second reference grating disposed between the photodetector and the
9 primary grating;
10 wherein the primary grating, the first reference grating and the light source are
11 configured for movement relative to one another.

1 2. The optical device of claim 1, wherein the primary grating is a moving
2 grating and the first reference grating and second reference grating are fixed gratings.

1 3. The optical device of claim 1, wherein the primary grating, light
2 source, first reference grating, second reference grating and photodetector are configured as
3 an optical position encoder device.

1 4. The optical device of claim 1, wherein the grating is a reflective
2 grating.

1 5. The optical device of claim 1, wherein the first reference grating and
2 second reference grating are configured for identical relative motion with respect to the
3 primary grating.

1 6. The optical device of claim 1, wherein the light source is a
2 semiconductor laser.

1 7. The optical device of claim 1, wherein the light source is an extended
2 light source.

1 8. The optical device of claim 7, wherein the extended light source is a
2 light emitting diode (LED).

1 9. The optical device of claim 1, wherein a period T_r of the first reference
2 grating and a period T of the second reference grating are related to a period T_s of the
3 primary grating by the following formula: $\frac{1}{T} + \frac{1}{T_r} = \frac{1}{T_s}$.

1 10. An optical position encoder device comprising:
2 a moving grating with a period T_s ;
3 a photodetector with light sensitive components;
4 a light source disposed on the photodetector;
5 a first fixed grating with spatial period T_r disposed on the light source; and
6 at least one second fixed grating with period T disposed on the light sensitive
7 components;
8 wherein the moving grating is moveable relative to the first fixed grating and
9 the light source.

1 11. The optical position encoder device of claim 9, wherein the light
2 source is an incoherent light source.

1 12. The optical position encoder device of claim 9, wherein $\frac{1}{T} + \frac{1}{T_r} = \frac{1}{T_s}$.

1 13. The optical position encoder device of claim 10, wherein there is a
2 plurality of second fixed gratings with a fixed phase relationship thereamong such that the
3 photodetector receives only one harmonic component.

1 14. The optical position encoder device of claim 13, wherein the plurality
2 of second fixed gratings are sinusoidal fixed gratings.

1 15. An optical device comprising
2 a primary grating;
3 a light source disposed opposing a predetermined side of the primary grating;
4 a first reference grating disposed between the light source and the primary
5 grating;
6 a photodetector disposed on a far side of the primary grating; and
7 a second reference grating disposed between the photodetector and the
8 primary grating;

9 wherein the primary grating, the first reference grating and the light source are
10 configured for movement relative to one another.